

# NESTING BEHAVIOR OF YELLOW-BELLIED SAPSUCKERS

LAWRENCE KILHAM

This communication presents aspects of the nesting of Yellow-bellied Sapsuckers (*Sphyrapicus varius*) either not mentioned in previous accounts (Bent 1939; Johnson 1947; Howell 1952; Kilham 1962a, b; Lawrence 1967) or, if mentioned, open to amplification and new or other interpretation. Activities covered extend from the start of excavating through egg-laying and incubation to fledging. They do not include agonistic and courtship behavior which are being described separately.

## METHODS

With 5 pairs studied in special detail and 4 others for a more limited time, I made observations from  $\frac{1}{2}$  to 2 hours a day every day, with a few missed from late April or early May through fledging in July, either between 08:00-10:00 or 15:00-17:00, these times having been found to be equivalent in terms of heights of activity. Percentages of time that the male or the female of a breeding pair spent in such activities as incubation or brooding refer, as shown in Tables 1 to 4, to total observation times, a method also used by Lawrence (1967). They are given for convenience of description and are not intended to imply total coverage that would have demanded dawn to dusk observations 7 days a week throughout the nesting period. In addition to counted hours (281) I spent many uncounted ones in partial observations on 12 other nesting pairs in Lyme, New Hampshire.

In regard to attentiveness I have not used methods employed, among others, by Stickel (1965), Lawrence (1967), and Skutch (1969). Stickel, who gives the most detail, designates "attentiveness as the time adults spent excavating a cavity, sitting beside it, guarding and incubating eggs, and once the birds had hatched, as that time the parents remained at the nest cavity." What Stickel refers to as sitting by a nest, guarding it, etc., I have considered under the general term of "loitering." Only those times, therefore, that the sapsuckers actually spent in the work of excavating, sitting on eggs, or brooding young within the nest, have been considered in making calculations. A session at the nest, in contrast, has been regarded as the total time that one of a pair spends in or by the nest until relieved by its partner.

Descriptions of the vocalizations, drummings, tappings, and displays of *S. varius* mentioned in this report are given elsewhere (Kilham 1962a).

## EXCAVATION

*Share done by males and females.*—The amount of work done by either sex depends on circumstances. At 5 nests that were first excavations of the breeding season, I found that the males did nearly all of the work. When they excavated, they worked continuously from 15 to 30 min at a stretch. When females changed places with them they spent much of their time in preening and resting as Lawrence (1967) has described. Their excavating was often token in character, with little sawdust removed, particularly after completion

of the entrance corridor. But females can work under special circumstances. When Pair A abandoned a first excavation in 1974 and began a second one, Female A (FA) did 63% of the excavating observed in the first 4 days. This was excavating of the hardest type, for FA dug through 6.5 cm of the living, outer shell of an aspen (*Populus tremuloides*). The aspen had heart rot due to infection with *Fomes ignarius* (Kilham 1971). When the easier digging at the center was reached, the male took over and did 79% of the excavating. The cavity was completed in the next 5 days.

FA worked so continuously in her first stretch that she took no time for resting and preening during periods of observation and on a number of occasions refused to leave when her mate came to change places. Why should she have worked in this manner? A possibility is that females are a reserve in regard to excavating. By not working under usual circumstances they conserve energy for forming and laying eggs. When a first excavation fails, a female that had been becoming ready physiologically for egg-laying, suddenly finds herself with no place to do so. As a result her drive to excavate may become even greater than that of her mate.

*Tight fit of nest entrances.*—A feature of holes in *Fomes*-aspens is that entrance corridors carved by males, when they do most of the excavating, are a snug fit for their bodies. Females do not usually enter nest cavities until the time of egg-laying when, if their body size is larger than that of their mates, they may have a hard time getting in. The first time I saw female C (FC) enter her nest cavity was on 20 May. She had to wriggle to force her way. After remaining inside for 5 min she had difficulties getting out. She pushed her head outside 5 times, moving it violently up and down as she struggled, without success until the 5th time, to force herself through. Even later on, when feeding young, she pumped her head up and down in struggles to emerge. I have observed the same phenomenon for a female Downy Woodpecker (*Picoides pubescens*) that had an even more difficult time emerging at the start of egg-laying. Female A, who had carved her own corridor, had no such difficulties.

*Attempt to reuse nest hole of a preceding year.*—Sapsuckers carve fresh nest holes each year. On 15 April 1975 Male D made the start of an excavation in a *Fomes*-aspen 8 days before I saw the female. The excavation was completed in May and used successfully. A pair of sapsuckers (Pair H) returned to the same aspen in 1976 but instead of starting a new excavation, for which there appeared to be no suitable sites, they attempted to reuse the old hole of the year before. This was evidenced by tapping, by the male entering and giving breeding calls from the entrance, and by courtship flights. On 29 April Male H entered twice, coming out with black fecal matter that appeared to be distasteful, for he wiped his bill many times on a pine limb.

Pair H abandoned the hole in early May and excavated a fresh one in a new *Fomes* aspen. It seemed from this experience that accumulation of fecal matter, which I had measured as being 6 cm deep at the end of the 1975 nesting season, had possibly acted as a deterrent to reuse of the old hole.

#### EGG-LAYING

FA was in Nest A from 05:35 until 06:35 on 2 June. This was longer than any single stretch that she spent during the incubation period. When MA came to the entrance at 05:57 as if to change places, she remained out of sight and when he returned at 06:21 she struck out sharply, driving him away. Similar behavior was observed in Female G on 24 May when she had 4 eggs in the nest. This dominance of the female at time of egg-laying may be a general phenomenon, for I have also noted it in the Common Flicker (*Colaptes auratus*; Kilham 1959).

In 1976 Pairs H and I finished their excavations by the middle of May. Egg-laying and the start of incubation that should have followed appeared to be delayed by 9 days of cold, wet weather. Although I did not find when first eggs were laid in either nest, Nest H contained 1 egg on 23 and 4 on 28 May, the first day of incubation. Of these eggs, only 2 hatched. The history of Nest I was more complicated. There were 3 eggs on 23 and 4 on 24 May. Neither the male nor the female appeared much disturbed when I put a ladder up to their nest. I was thus unable to account for destruction of 3 eggs that I watched Male I carry from the nest on 25 May. On 29 and 30 May a single egg remained. Four more were laid between 1 and 4 June. Of this total of 5 eggs, 3 hatched. There were thus high rates of failure (50% in H and 40% in I) in both nests. These failures to hatch may have related to exposure during the prolonged spell of cold weather. The percentages of egg failure appear high. Ricklefs (1969) found that only 8.1% of 3226 eggs of 6 passerine species failed to hatch. All 5 of the unhatched sapsucker eggs were removed by the parent sapsuckers within a day.

#### INCUBATION

Although most pairs settled down to incubating promptly, the females of Pairs C and D frequently loitered outside of their nests following changeovers with their mates during the first 5 days of incubation. In the last 6 or 7 days of incubation, they became more attentive than the males, FC doing 60% and FD 86% of the total incubating.

Experience of a following year with Pairs H and I is shown in Table 1. Here the 2 females incubated from the beginning of the period and were as attentive or nearly so as the males in their sessions at the nest. As their ses-

TABLE 1

ATTENTIVENESS OF MALES (M) AND FEMALES (F) OF 2 PAIRS OF SAPSUCKERS DURING INCUBATION AND BROODING; BOTH FEMALES WERE BLACK POLY MORPHIS

Activity	Pair and Sex	Total time of sessions (min)	Attentiveness
Incubation	HM	610	94%
	HF	293	94%
	IM	239	97%
	IF	189	93%
Brooding	HM	375	80%
	HF	236	83%
	IM	107*	85%
	IF	184*	58%

\* Regular brooding only lasted 4 days in contrast to 9 days for Pair H.

sions were fewer than those of the males, the latter did the greater part of the incubating in both pairs.

I have found sapsuckers very restless during incubation periods, often looking or coming out of their nest holes, regardless of how near or far away I sat watching. These periods of abandoning the eggs added up to considerable amounts of time, especially in the case of the females. Thus in nearly 31 hours of watching at Nests A, C, and D (Table 2) I found that eggs were left uncovered for a total of 5 hours or close to 16% of the time.

Can weather affect incubating? This appeared to be the case on only one day for the 3 pairs of sapsuckers shown in Table 2. The hottest day of the spring of 1974 was on 10 June which was the 8th day of incubation for Pair A. The temperature was 36°C in the shade and presumably hotter in the nest hole that was exposed to the mid-afternoon sun. Although the members of this pair had been incubating close to 100% of their time for the previous 3 days, they became very restless on 10 June leaving their eggs unguarded for 34 out of the 60 min that I watched them.

#### PERIOD OF FEEDING YOUNG

*Brooding.*—I have considered brooding as the days when each member of the pair remained on the nest for a high percentage of its time until relieved by its mate. Tables 1 and 3 give ranges of these percentages that, as shown in Table 1, were lower than those noted during the period of incubation. As nest J were brooded 82% of the time I watched, the 3 young of nest I were

TABLE 2  
AMOUNTS OF TIME EGGS WERE LEFT UNCOVERED DURING PERIODS OF OBSERVATION  
IN INCUBATION PERIODS OF 3 PAIRS OF SAPSUCKERS

	Pair A	Pair C	Pair D
Duration of observations (min)	520	782	550
% of observation times eggs left uncovered	6%	18%	23%

shown in Table 3 brooding was of 8 to 10 days duration. I did not consider as brooding the periods of 2-4 min that sapsuckers spent in nests on subsequent days. On some of these I could hear excavating. This suggested that the males (and less often the females) were producing sawdust used in relation to removal of fecal matter from the nest (Kilham 1962b).

There were 2 exceptions to stoppage of brooding on a definite day. One was with Pair A that, after ceasing to brood on 24 June, brooded for 42 of 60 min on 26 June which was rainy and exceptionally cold. The other was with Pair I (Table 1) where the brooding was regular only through day 4, then irregular and infrequent until day 7 when it ended.

As shown in Table 4 and described in the following section, I had nests with 1, 2, 3, and 4 young. A point of interest was that whereas the 2 young of Nest J were brooded 82% of the time I watched, the 3 young of Nest I were brooded 67 and the 4 young of Nest A 73%. While the differences were not great, the nest with the fewest young received the most brooding. Royama

TABLE 3  
RESULTS OF OBSERVATIONS ON THE NUMBER OF DAYS 3 PAIRS OF SAPSUCKERS BROODED  
THEIR NEWLY HATCHED YOUNG AND THE WAYS DUTIES WERE SHARED BETWEEN  
MALES (M) AND FEMALES (F)

Parameters	Pair A		Pair C		Pair D	
	M	F	M	F	M	F
Amounts of time sexes brooded (min)	251	220	163	164	94	120
Percentages of total time	53%	47%	50%	50%	44%	56%
Average duration of periods M and F brooded (min)	19		16		13	
Duration of brooding (days)	9		10		8	
Observation time (min)	644		360		321	
Percent of observation time that sapsuckers brooded	73%		91%		67%	

TABLE 4

EFFECTS OF NUMBER OF YOUNG IN THE NEST (1, 2, 3, OR 4) ON FEEDING RATES OF PAIRS OF SAPSUCKERS AND ONE LONE MALE\*

Period	Pairs of Sapsuckers							
	J = Lone Male		H		I		A	
	No. of young	Rate/h	No. of young	Rate/h	No. of young	Rate/h	No. of young	Rate/h
Brooding			2	7.3	3	9.3	4	10.6
End of brooding thru day 15 after hatching		(Nest not under observation)	2	13.4	3	15.4	4	17.1
Last 9 days before nest leaving	1	6.2	1**	10.1	(End of nest; predation by weasel?)		4	20.8
Day of nest leaving	—————		26		—————		28	

\* Observation time, 89.4 h.

\*\* 1 died; cause unknown.

(1966) writing of the Great Tit (*Parus major*) emphasizes that there was greater heat loss in small broods, where young were less efficient at keeping each other warm. They would, therefore, need more brooding and/or more feeding.

*Feeding young.*—A feature of feeding young noted at all nests was that the sexes shared the tasks almost equally, with the males making 6 to 10% more visits than their partners (Fig. 1). Figure 2 gives the combined male plus female feeding rates of Pair A. I found by inspection that Nest A contained 4 young and I visited it for an hour or more every day from hatching on 15 June to fledging 28 days later. After a low average of 10.5 when parents were spending much of their time brooding, the rate jumped to 24 visits per hour with its cessation. This high average continued to within 4 days of fledging when it fell to 16. Findings with Pair D, recorded in a similar manner, followed an almost identical curve. A feature of Lawrence's paper is the all-day feeding rate. My nests were visited either in the mid-morning or mid-afternoon, at which times I found no differences in rates as would seem to be the experience of Lawrence (1967:116) as well.

As stated by Lawrence (1967:113) "it is difficult to arrive at a valid analysis of the feeding rate without knowledge of the exact number of young." I was fortunate in 1976 to have 3 nests that, being within 3 to 5 m of the ground were easily accessible by ladder. These nests contained 1, 2, and 3



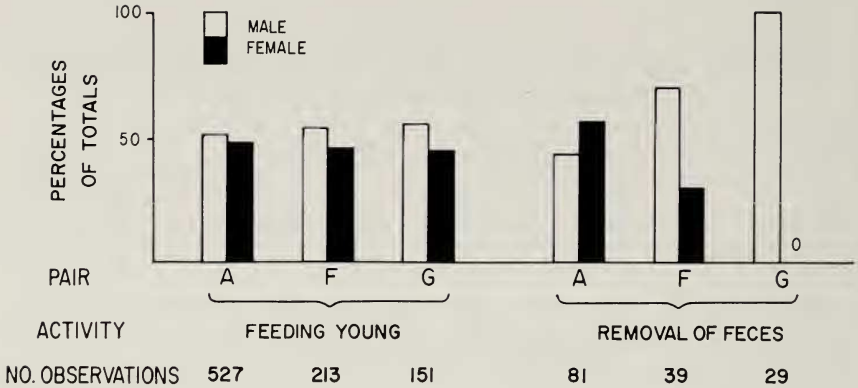


FIG. 1. Observations on 3 pairs of nesting sapsuckers showing that while the task of feeding the young was shared by both sexes to a nearly equal extent in all pairs, that of nest sanitation varied considerably. Observation times, here combined, were between 08:00-10:00 and 15:00-17:00.

young, while Nest A in 1974 contained 4. As shown in Table 4 the feeding rates declined in stepwise fashion from Nest A with 4 young to Nest H with only 2. But the decline was not proportionate to the number of young, for the fewer the nestlings, the more each one received from its parents. These extra feedings may have hastened the time of nest leaving; the single nestling in Nest H, for example, having left on day 26 as contrasted with the 4 nestlings of Nest A that left on day 28.

Pair H provided an exception to the finding that males and females, in general, fed young almost equally. Although the members of the pair had shared the feedings almost equally when they had 2 young, the male did almost all of the feeding (75%) in the last 9 days when only a single nestling remained.

*Vocalizations of nestlings.*—The vocalizations of nestling sapsuckers are described by Lawrence (1967:125) as well as by Kilham (1962a). They carry for considerable distances and can be of aid in locating nest trees. They might, therefore, also serve to attract predators. If they are a hazard they must, it would seem, provide compensating advantages. It is conceivable that the harsh “check-check-checks” of the young stimulate parents to keep the feeding at a high rate and to thus raise more young. A line of evidence suggesting that the vocalizations do stimulate adult sapsuckers involves intrusions by lone adult male and female sapsuckers. In sapsucker nests that I followed every day through the nestling period I seldom saw these intruders until the last week or two of the nestling period when they began coming to nest trees, sometimes repeatedly, to look into the nest hole in spite of being driven away.

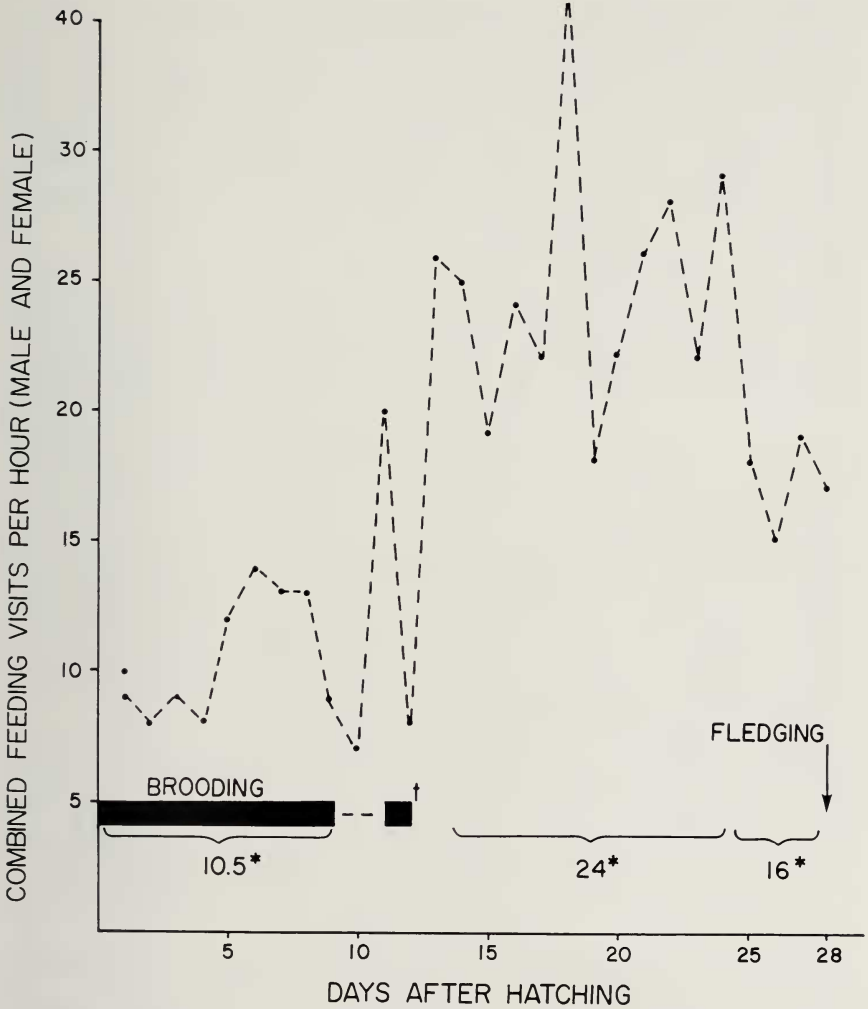


FIG. 2. Curve of combined male plus female feeding rates of a pair of nesting sapsuckers, showing sharp increase of rate at termination of brooding. Observation times, here combined, were between 08:00-10:00 and 15:00-17:00.

They thus behaved as if something, such as the vocalizations that carried for a distance, were attracting them.

A parent sapsucker, on the other hand, may return repeatedly to an empty and silent nest. The young of Pair A left early on the morning of 13 July. Male A came to the hole later, bowed in 3 times, then left to add sap to his



bill-full of insects before returning. He made 5 such visits before flying off to feed the insects plus sap to a juvenile. The behavior of Male I was even more striking. After his young had been killed by a predator, he came to the hole 10 times in 17 min with a load of insects that became steadily larger as he continued to catch insects between visits. On his 10th visit, MI swallowed the insects and left. The return of MA and MI to their silent nests was possibly due to habituation over previous days. Skutch (1976) noted a Golden-naped Woodpecker (*Melanerpes chrysauchen*) that continued to bring food for 6 days after a nest was desolated.

The range of vocalizations of nestlings is considerable and probably conveys a variety of messages ranging from hunger to alarm. A peculiar episode took place at Nest D the day before nest-leaving when an intruder, a female, ascended the nest aspen cautiously, then poked in at the nestlings. They immediately set up a wailing noise that I had not heard previously and continued it for 30 sec after the intruder had left. The reaction suggested that the young sapsuckers were able to recognize the intruder as being a foreigner and not their own mother.

*Nest sanitation.*—Both Johnson (1947) and Lawrence (1967) noted that males do most of the nest cleaning, but I have found more variation in this task than in feeding the young (Fig. 1). Among 7 pairs of sapsuckers followed in the same manner, the amount of the work done by the females ranged from 0% in 3, to 2, 22, 30, and 56% respectively in 5 other nests. In one out of 7 therefore, the female did more than the male.

Another parameter showing variation is the day when parents cease to remove feces. In 3 nests, those of Pairs F, H, and A, this was 4, 5, and 8 days before the young left the nest. The amount of black, tarry fecal matter that accumulated in Nest H was 5 cm and in Nest A, 6 cm deep as measured afterward. Male G, in contrast to males of other pairs, removed 7 large bill-fulls of feces in 30 min on 22 July, the day before fledging, and Lawrence (1967:120) saw a male remove feces after 1 fledgling had left.

*Emergence.*—At 07:10 on 30 June, about 30 sec after it had been fed, a juvenile flew from its nest hole on a circular, downward flight that carried it 6 m to a stub, where it rested silently. The young one had been looking about with its head out of the hole for the previous hour. Neither at this nor any other nest have I seen parent sapsuckers make special efforts to induce young to leave.

#### OTHER ASPECTS

*Lone parents.*—I have encountered 5 nests where young were tended by widowed parents, of which 3 were females and 2 males. Behavior differed between the sexes. Whereas the females fed their young at exaggerated rates

of up to 20 to 28 times per hour, bringing little prey with each visit, the males fed at a slow rate, closer to what they would have used had their partners remained alive. Thus lone Male J (Table 4) fed its single young at a rate of 6.2/h in the last 9 days of the nestling period. Male H, who also had a single young but had a mate, fed at a rate of 7.7/h.

Of the 5 nests with lone parents, 4 failed, 1 due to predation and the others, I believed, to starvation, for the vocalizations of the young became very feeble. Male J raised one young successfully and Lawrence (1967:117) describes a lone male that raised and fledged 2 young. It would seem from these experiences that males are more apt to succeed in raising young alone than are females. As described elsewhere (Kilham, in press) one of the lone females I watched succeeded in attracting a new male that, after 2 days, started to feed her young. The nest, however, was destroyed by predation on the following night.

*Predation by weasel (?)*.—The aspen of Pair I was 1 m from a stone wall. I noticed a weasel (*Mustela* sp.) running along the wall on 11 June when Female I made "quare" notes in alarm. The weasel stood up to look at me at close range. On 30 June I found remnants of a nestling, with wing feathers still in sheaths, below the hole and similar remains at the bottom of the nest. The predator had seemingly been able to enter. There was no ring of tooth marks around the entrance, such as I have noticed when raccoons attack a sapsucker nest (Kilham 1971). On examining a rough place on the bark at the foot of the aspen, I collected over 30 whitish hairs a centimeter or slightly more in length; hairs that might have come from the belly of a weasel. Although a snake might have entered, there are no tree climbing snakes in woodlands of central New Hampshire, to my knowledge, and a snake would have swallowed its prey whole. A presumption, therefore, was that a weasel was the predator. Johnson (1947) described attacks of a weasel on a sapsucker nest.

*Temperament*.—How close should one sit when in the open and without a blind? When a sapsucker is disturbed by one's being too close, it makes repeated "waan" notes, raises its crest, alights on the opposite side of the nest tree from the observer, and may bow into the hole repeatedly before entering. These signs of shyness are generally present at the start of a breeding season, but largely disappear as nesting progresses. The members of a pair may then appear remarkably tame. When I set a step ladder by Nest H, the parents fed their nestlings without hesitation when I was less than 3 m away. An occasional individual is more shy. Female I was unusually nervous, but this was mainly on her first visit to the nest after I had arrived. By a second or third visit she entered the nest with little hesitation. I never felt that my sitting close (at 7–8 m) ever kept her from an intended visit

to eggs or young. The curious thing was that at Nest H where the members of the pair were both tame, MH made 59% and his mate 41% of the feeding visits. At Nest I, at the same height (4 m) above the ground, MI made 105 and FI, the shy female, 104 of the feeding visits made as I watched close by; these figures supporting an impression that FI was not unduly disturbed. The reason for sitting close to the nests was that I wanted to see, as clearly as possible, the types of prey parents were feeding nestlings.

*Insects fed to nestlings.*—Sapsuckers are versatile insect catchers, moving rapidly up trunks and limbs to glean from bark; flying against clusters of leaves and, on warmer days, catching prey in midair. They occasionally go to the ground, possibly more on wet days. They thus appear to catch insects of a wide variety in New Hampshire and I have never noted that they pick up ants any more than casually. Only a very small fraction of their prey, furthermore, is caught near their sap holes (Kilham 1964).

The size of prey may vary considerably. On 7 June 1968 I watched a male fly to the ground to catch a luna-sized moth which it carried to an "anvil" of rough bark. He pulled off the wings, then fed the body to a nestling that was 4 days from fledging. The male stayed by to poke in at the nestling to assist it in managing its large meal. On 17 July of another year I watched a male struggle with a willow sawfly (*Cimbex*) 3.4 cm in length. After battling for some minutes, the sapsucker gave up and I recovered the crippled but unsubdued insect from the ground.

Although sapsuckers pick up very small prey such as ants, it has seemed, from observations made close to nests, that most insects fed to young are large and more soft-bodied. Thus, to cite Pair C as an example, I noted between days 5 and 18 after hatching, that the male in 32% of 59 visits and the female in 34% of 73 visits, had legs and gauzy wings of insects projecting a centimeter or more from their bills. On a number of occasions I have watched foraging sapsuckers pause to compact their load of insects, bringing into their bills all projecting appendages; then after more foraging, fly to feed their young with no sign of larger prey being visible. This has made it seem that what one actually sees in bills at times parents arrive at the nest may be only a crude index of how much larger prey they are actually catching. Beetles, furthermore, of a centimeter or more in size, are usually so beaten and dismembered as to be difficult to recognize.

In June in New Hampshire I have found large crane flies (*Tipula* sp.) to be common in woods where I have watched sapsuckers. These may have accounted for many of the legs and wings projecting from parents' bills. On one morning after a rain, FH flew to the ground and picked up a smooth larva, 2.5 cm long, possibly of a crane fly.

In two successive years the male at one nest aspen carried feces to a place

3 m above ground on a low tree, discarding his load against the bark. I cleared the ground below and was thus able to make daily collections. A sample of these, as kindly examined by Dr. G. Thomas Fisher, Dept. of Entomology, University of New Hampshire, contained for the most part remnants of major and minor workers of carpenter ants (*Camponotus pennsylvanicus*). These findings coupled with those of Beal (1911) have made me feel that the remains of ants pass through digestive tracts particularly well. As guides to what sapsuckers actually feed nestlings, however, they may be deceptive. Other views and experiences on the subject of sapsucker foraging are given by Lawrence (1967) and Tate (1973).

While sapsuckers bring sap as well as insects to nestlings, I have never seen them bringing fruit. This may be because trees fruiting in June and early July were scarce in woods where I did my watching. Sapsuckers are not unique in bringing sap to feed young, for Thönen (1966) has noted the same habit in the Three-toed Woodpecker (*Picoides tridactylus*) of Europe.

*Black polymorph females.*—In the course of studying sapsuckers over 25 years and finding 69 nests, I have encountered 12 females that were "black polymorphs" having black or nearly black crowns. Attempts to find consistent differences in their breeding behavior have been unsuccessful.

#### DISCUSSION

Males were the more domestic-minded of pairs of sapsuckers studied in New Hampshire. While females sometimes equaled them in attentiveness to incubating, brooding, and, for periods, feeding nestlings, males generally performed the larger share of these activities as well as doing most of the excavating and nest cleaning. The females might be regarded as a reserve, exerting themselves to the full when a nest contains a full brood of 4 or more. In a nest with only 1 nestling, on the other hand, as was the case with Nest H, the female left almost all of the care to the male.

This greater role of males may explain differences of behavior in lone males as compared to lone or widowed females. Of 3 lone males, to combine one described by Lawrence (1967) with 2 of mine, 2 succeeded in raising their young, feeding them in normal fashion. Of 3 females that I observed, all fed their young in an inefficient, exaggerated fashion. The nestlings of 2 died, seemingly of starvation. The third lone female succeeded in attracting a new mate who started to feed the nestlings 2 days later (Kilham, in press). A point of comparison was that while one of my lone males and one of Lawrence's attracted new females, these new females, although they came to the territory, showed no interest in the nests. This is perhaps what one might predict, females being on the whole the less domestic-minded. The successful remating, in terms of care of the young, involved a new male.



Lawrence's account (1967) of the nesting of sapsuckers in Ontario differs from mine in a number of respects. One is where (pp. 95–96) she states that of 4 woodpeckers (of which one was the sapsucker) that she studied, none left "their eggs uncovered more than a minute or two at a time or, to be exact, a total of 27 min in 90 hours of observation." Were my observations of much more time (Table 2) unusual? It would not seem so from what other observers have recorded for other picines. Thus, Skutch (1969:469), during 5 hours of observing Red-crowned Woodpeckers (*Melanerpes rubricapillus*), noted that they left their eggs uncovered 36 min or 22% of the time. The restlessness that he describes for this and for the Golden-naped Woodpeckers in the incubation period is almost exactly what I have noted for *S. varius*. Although he only gives times of actually incubating in his table (p. 486) his figures for 4 pairs of *M. chrysauchen* show that they left eggs uncovered for 0, 10, 11, and 24% of the time respectively. Skutch's experiences with Acorn Woodpeckers (*M. formicivorus*) were similar for in one watch of 11.5 hours, he found eggs were left uncovered for 141 min. One can say that all of these species were melanerpine and observed in the subtropics. It is of interest, therefore, that Pynönen (1939:114), in all-day watching at 2 nests of Greater Spotted Woodpeckers (*Picoides major*) in Finland, found eggs left uncovered for periods totaling 5–6 h for one pair and 4 h for the other. The most restless woodpeckers I have observed were a pair of Hairy Woodpeckers (*P. villosus*) in Lyme. Both the male and female left eggs uncovered up to 30 and 40% of tours on duty on the nest and this was throughout the incubation period, as judged by periods of watching limited to 40–90 min at a time that I made on scattered days, at a distance that was far enough away not to frighten them.

To cite Skutch's account (1969) again there are parallels in nest sanitation between *S. varius* and at least 3 species of *Melanerpes* woodpeckers. He states that Golden-napes "often allow nestling's droppings to accumulate in the hole and then remove them in a spell of concentrated house cleaning." Golden-napes use their nest cavity for roosting after fledging and keep it clean the whole time. On the other hand Golden-fronted (*M. aurifrons*) and Red-crowned woodpeckers, that do not use theirs after fledging, "appear not to clean the nest at all after the young birds can take their meals through the doorway." Sapsuckers appear to be ambivalent in this regard, some pairs ceasing well before and others continuing to carry out feces until the time of nest leaving.

The functions of the loud, persistent vocalizations of nestlings, that could attract predators, is a subject that needs further study. As pointed out by Skutch (1976) they are possibly more important in hole-nesters that cannot be guided by the speed, strength, and color of gaping reactions when feeding

young in a darkened nest cavity. The best experiments are seemingly those of von Haartman (1953). He was able to show, by dividing a nest box of the Pied Flycatcher (*Muscicapa hypoleuca*), that the rate at which parents fed their young was not guided by their number but by the clamor raised by the hungriest of them. If birds of temperate zones raise the largest broods possible, then begging cries would seem a device that might insure efficient and constant feeding. Quite opposite to these views, however, are those of Lawrence (1967:125) who states that she "found no evidence of the woodpecker nestlings "chatter notes" having any direct stimulating effect upon parents' feeding rates."

Differences of opinion are, or should be, a stimulus to further studies. If the natural history of sapsuckers or other woodpeckers is to be known with any completeness, it would seem that far more studies are needed by different observers studying them and their nesting habits in different parts of their total range.

#### SUMMARY

Activities covered in this report extend from excavation through time of fledging of Yellow-bellied Sapsuckers. Males did nearly all of the excavating. When a first excavation failed, one female excavated harder and longer than her mate in starting a new one. Two females were dominant at the nest hole at time of egg-laying. Males started incubating more promptly than some females, but after 4 to 5 days delay, females of 2 nests incubated more than their mates in daylight hours. Eggs were left uncovered 16% of the time. The tasks of brooding and feeding the young were shared by both sexes almost equally. When free of brooding, which lasted for 8-10 days, the combined feeding rate of the sexes doubled almost immediately in 2 pairs. Males did the most of the nest cleaning.

Comparisons are made of feeding rates of parents caring for 1, 2, 3, and 4 young and of the behavior of 2 lone or widowed males as compared to 3 lone females. Both situations brought out the greater role of males. The loud vocalizations of young sapsuckers are considered as having selective value in stimulating parents to a high rate of foraging and feeding of nestlings.

#### LITERATURE CITED

- BEAL, F. E. L. 1911. Food of the woodpeckers of the United States. U.S. Dept. Agr. Biol. Surv. Bull. 37.
- BENT, A. C. 1939. Life histories of North American woodpeckers. U.S. Natl. Mus. Bull. 174.
- HAARTMAN, L. VON. 1953. Was reizt den Trauerfliegenschnäpper (*Muscicapa hypoleuca*) zu futtern? Vogelwarte 16:157-164.
- HOWELL, T. R. 1952. Natural history and differentiation in the Yellow-bellied Sapsucker. Condor 54:237-282.
- JOHNSON, R. A. 1947. Role of male Yellow-bellied Sapsucker in the care of the young. Auk 64:621-623.
- KILHAM, L. 1959. Early reproductive behavior of flickers. Wilson Bull. 71:323-336.
- . 1962a. Breeding behavior of Yellow-bellied Sapsuckers. Auk 79:31-43.



- . 1962b. Nest sanitation of Yellow-bellied Sapsucker. *Wilson Bull.* 74:96-97.
- . 1964. The relations of breeding Yellow-bellied Sapsuckers to wounded birches and other trees. *Auk* 81:520-527.
- . 1971. Reproductive behavior of Yellow-bellied Sapsuckers. I. Preference for nesting in *Fomes*-infected aspens and nest hole interrelations with flying squirrels, raccoons and other animals. *Wilson Bull.* 83:159-171.
- . Altruism in nesting Yellow-bellied Sapsucker. *Auk* (in press).
- LAWRENCE, L. DE K. 1967. A comparative life-history study of four species of woodpeckers. *Ornithol. Monogr.* No. 5.
- PYNNÖNEN, A. 1939. Beiträge zur kenntnis der biologie finnischer spechte. *Ann. Soc. Zool-Bot. Fennica Vanamo* 7:1-166.
- RICKLEFS, R. E. 1969. An analysis of nesting mortality in birds. *Smithson. Contrib. Zool.* No. 9:1-48.
- ROYAMA, T. 1966. Factors governing feeding rate, food requirement and brood size of nestling Great Tits *Parus major*. *Ibis* 108:313-347.
- SKUTCH, A. F. 1969. Life histories of Central American Birds III. *Pacific Coast Avifauna* No. 35.
- . 1976. Parent birds and their young. Univ. Texas Press, Austin.
- STICKEL, D. W. 1955. Territorial and breeding habits of Red-bellied Woodpeckers. *Am. Midl. Nat.* 74:110-118.
- TATE, J. JR. 1973. Methods and annual sequence of foraging by the sapsucker. *Auk* 90:840-856.
- THÖNEN, W. H. 1966. Dreizehenspecht futtert nestjunge mit baunsaft. *Ornithol. beobachter* 63:21-23.

DEPT. OF MICROBIOLOGY, DARTMOUTH MEDICAL SCHOOL, HANOVER, NH 03755.  
ACCEPTED 1 MAR. 1976.